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Keep Your Mood Stable!

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Chapter 1

General Introduction

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More than 100 years ago, Stanley Hall (1904) wrote that adolescence “is the age of [...] rapid fluctuation in mood” (p. xv), where experiences of “great and frequent alternation of mood from grave to gay” (p. 297) are anything but uncommon. Adolescent mood fluctuations have since then become a popular topic in the field of clinical and developmental psychology. Although the overly generalized view of Hall (1904), in which emotional turmoil during adolescence is inevitable, is nowadays regarded as too dramatic and deterministic (Arnett, 1999; Buchanan & Hughes, 2011; Dahl, 2004), there is no doubt that adolescence is a time, in which mood goes through important changes. During adolescence, youths need to learn how to regulate their moods more independently from their parents (Morris, Silk, Steinberg, Myers, & Robinson, 2007), which makes it a sensitive period for the development of emotion regulation and mood variability. Heightened mood variability is defined as “frequent and extreme changes in mood or emotion over time” (Larsen, 1987, p. 1195) and has been regarded as an indication that individuals cannot adequately regulate their moods (Cole & Hall, 2008; Hoeksma, Oosterlaan, & Schipper, 2004; Larsen, 2000). Emotion regulation is important for our well-being and emotion dysregulation in turn is a central feature in many forms of psychopathology (Bradley, 2000; Cole & Hall, 2008).

Despite the hypothesized role of mood variability in psychopathology (Trull, Lane, Koval, & Ebner-Priemer, 2015; Wichers, Wigman, & Myin-Germeys, 2015) and the notion that adolescence is a critical period for emotion regulation (Rosenblum & Lewis, 2003), research on mood variability in adolescence, especially longitudinal research, is still scarce. This is unfortunate, because without longitudinal data, we cannot draw conclusions about developmental trends or direction of effects in longitudinal associations with adjustment. The present thesis aims to get a better understanding of the development of mood variability as well as its association with adjustment during adolescence. In this general introduction, I will first give an overview of the concept and definition of mood variability as used in the present thesis. Second, I will discuss how mood variability was measured and point to some issues that need to be addressed in this measurement. Third, I will elaborate on the

theoretical background and empirical evidence concerning the development of mood variability during adolescence. Fourth, I will discuss the role of mood variability in psychopathology in the context of interpersonal relationships. Finally, I will summarize the research questions that guided my work and present the design and outline of the present dissertation.

The Concept of Mood Variability

In our everyday lives, emotions arise in response to events that are considered meaningful and important to us¹. Emotions signal that something is going on in our environment, something that is important to us and deserves our attention. Events that bring us closer to our aims are typically associated with positive emotions, whereas events that jeopardize our aims are typically associated with negative emotions (Frijda, 1988). By that, emotions stimulate us to take action in order to cope with and regulate that emotion (Frijda, 1988; Kuppens, 2015). Thus, the regulation of emotions plays a central role in our functioning (Larsen, 2000). Several researchers have conceptualized emotion regulation as a controlled feedback process (Carver, 2015; Chow, Ram, Boker, Fujita, & Clore, 2005; Hoeksma et al., 2004; Larsen, 2000). Similar to a thermostat, individuals continuously compare their current emotional state with their desired emotional state and, if discrepancies arise, employ regulatory mechanisms (e.g., emotional distraction) to diminish this discrepancy.

To give an example, imagine a PhD student, who is just about to write her general introduction. This might induce increases in anxiety, because she worries about the fact that her time as a PhD student is over as soon as she finishes her thesis. However, a high amount of stress and anxiety is obviously quite impairing

¹ A little cautionary note: In this dissertation, the words affect, emotion, and mood are often used interchangeably, although this is strictly speaking not appropriate. Affect includes all valenced states and is thus a broad category that contains both emotions and moods (Gross, 1998; Larsen, 2000). Moods and emotions in turn can be distinguished, amongst other things, on their time course and causes. Mood refers to states that build up gradually and are long-lasting, whereas emotions have a clear start and end point and are usually short-lived. In addition to that, emotions usually have a clear cause, whereas there are often no identifiable causes for moods (Ekman, 1994; Gross, 1998; Larsen, 2000).

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while writing an academic text. She sees that there is a discrepancy between her current (i.e., anxious and worried) and her desired (i.e., calm and focused) state and searches for ways to diminish that discrepancy. She could for instance talk to her supervisors about her fears or try to see the positive things about finishing her PhD, which would likely decrease her anxiety.

Based on such models of controlled feedback processes, several researchers have proposed that one way to study emotion regulation is to examine the changes in mood over time or in other words to examine the variability in mood states (Cole & Hall, 2008; Hoeksma et al., 2004; Kuppens & Verduyn, 2015; Trull et al., 2015). Individuals with fewer resources to regulate their emotions might suffer from more frequent and extreme changes in their moods (i.e., show higher levels of mood variability; Hoeksma et al., 2004). Indeed, studies have shown that less adaptive emotion regulation strategies (e.g., rumination) are associated with greater fluctuations in negative emotions (Brans, Koval, Verduyn, Lim, & Kuppens, 2013; Moberly & Watkins, 2008; Silk, Steinberg, & Morris, 2003). For the present dissertation, I adopted the conceptualization of mood variability as an indicator of emotional (dys)regulation.

Using Daily Diaries to Assess and Model Mood Variability

Based on the definition of mood variability that was adopted for the present study (i.e., frequency and intensity in mood changes; Ebner-Priemer, Kuo, Kleindienst, Welch, Reisch, Reinhard et al., 2007; Larsen, 1987), the next question addresses the operationalization of mood variability. In the present dissertation, daily diaries were used to study mood variability. Specifically, adolescents rated their emotions using internet daily diaries once per day for three weeks per year across the period of adolescence (i.e., a total of five years). Mood variability scores were calculated as day-to-day mood changes. Using daily diaries to study mood variability has several advantages over more traditional retrospective assessments, in which adolescents (or external raters) estimate how much and frequently they change in their moods across a defined period (Cook, Buehler, & Blair, 2013;

Mulraney, Melvin, & Tonge, 2014; Stringaris & Goodman, 2009). First, repeated assessments make it possible to study within-person variability or, in other words, to model the actual changes in mood (Gunthert & Wenzel, 2012). Second, daily diaries minimize recall biases and may therefore provide more reliable estimates than retrospective measures. This is because retrospective measures require raters to summarize a large amount of information and to aggregate changes in their mood over time, which may be difficult and therefore make such retrospective measures less accurate (Solhan, Trull, Jahng, & Wood, 2009; Trull et al., 2015). Lastly, given that emotions are measured in real-life, daily diaries provide a snapshot of the participants' daily lives and therefore possess high ecological validity (Shiffman, Stone, & Hufford, 2008).

Of course, using more intense measures (i.e., not once-per day, but within-day assessments) may also be possible. Emotions are very dynamic and therefore summarizing emotions over the course of one day may be difficult (Shiffman et al., 2008). However, although the recall bias in daily diaries may be stronger compared to more intense within-day assessments, such biases may still be much smaller compared to global retrospective assessments (Gunthert & Wenzel, 2012). Moreover, given that in the present study adolescents were followed over a large time span, namely five years, within-day assessments would probably be associated with overall low compliance and tolerance rates (Gunthert & Wenzel, 2012). Therefore, daily diaries were chosen to measure mood variability in the present study.

Using these daily scores, we calculated day-to-day mood variability scores. Mood variability is characterized by three characteristics: amplitude (i.e., how large the changes are), frequency (i.e., how frequent the changes are), and temporal dependency (i.e., when the changes happen in time; Ebner-Priemer et al., 2007; Larsen, 1987). An adequate way to operationalize all three characteristics of mood variability is the mean absolute or squared successive difference, in which absolute or squared differences between consecutive time points are averaged (Ebner-Priemer, Eid, Kleindienst, Stabenow, & Trull, 2009; Ebner-Priemer et al., 2007; Jahng,

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Wood, & Trull, 2008). Although the standard deviation has often been used to operationalize mood variability (Larson, Moneta, Richards, & Wilson, 2002; Silk et al., 2003), it does not take into account temporal dependency (i.e., when the changes happen in time; Ebner-Priemer et al., 2007; Larsen, 1987). To overcome the limitation of standard deviation scores, we calculated mood variability using the mean absolute successive difference in the present thesis².

Considerations when using Daily Diaries to Study Mood Variability

As will be outlined later in greater detail, a large focus of the present thesis lies on the development of mood variability and its longitudinal linkage with adjustment, while additionally taking into account possible sex effects. In other words, we wanted to know whether adolescents became more stable or unstable in their moods across adolescence, whether this was the same for boys and girls, and whether there were distinct subgroups of adolescents with different mood variability trajectories. Moreover, we wanted to know whether one needs to worry if adolescents show heightened levels of mood variability. Specifically, what is the impact of frequent and extreme changes in adolescent mood for psychopathological outcomes and interpersonal relationships? However, there are two issues that will be outlined in the following two sections that need to be addressed before studying such topics.

² Of course, other possibilities exist as well. Several researchers do not aggregate daily mood data into standard deviations or mean absolute successive differences, but employ multilevel models, for instance to study changes in daily moods in response to daily events (Flook, 2011; Schneiders, Nicolson, Berkhof, Feron, van Os, & deVries, 2006; Weinstein, Mermelstein, Hedeker, Hankin, & Flay, 2006). Furthermore, it needs to be noted that some researchers make a clear distinction between mood variability and mood instability (e.g., Houben, Van Den Noortgate, & Kuppens, 2015; Koval, Pe, Meers, & Kuppens, 2013), with the first referring to the range of emotional experiences across time, commonly assessed with the standard deviation, and the latter referring to the frequency and intensity of changes from one moment to another, commonly assessed with the mean squared or absolute successive difference. In the present thesis, both variability and instability are used interchangeably to describe frequency and intensity of emotion changes, as measured with the mean successive difference.

Measurement Invariance

Daily diaries are quite time-intensive measurements, which also raises questions about the appropriateness of using such measurements. Specifically, before drawing conclusions about developmental changes, longitudinal relations, or sex differences, one needs to ensure that one actually measures the same construct – between boys and girls and across different time points. This is referred to as measurement invariance. If we do not measure the same thing in the same metric between different groups or time points, then any conclusions regarding differences between these groups or different time points are likely to be obscured (Chen, Sousa, & West, 2005; Gregorich, 2006; Little, Preacher, Selig, & Card, 2007; Vandenberg & Lance, 2000; Widaman, Ferrer, & Conger, 2010). For instance, when measuring emotions with a number of items, we need to make sure that the same items contribute in the same way to the overall scores between boys and girls and across time (i.e., that the items have the same importance for the underlying emotion between sex and across time). Moreover, we need to ensure that the same threshold is used when rating emotion items. If there are systematic differences between boys and girls or across time (e.g., when girls rate their emotions in general higher than boys although they actually experience the same emotion), then comparisons across sex and time are biased. In time-intensive measurements that span over several years, as is the case in the present study, the issue of measurement invariance becomes even more vexing, because changes in the measurement can occur within smaller (e.g., across days) and larger time intervals (e.g., across years). Unfortunately, few studies explicitly test measurement invariance assumptions (Widaman et al., 2010).

But are there reasons to assume that the measurement of daily emotions differs across different time points or across sex? Yes, there are. If we take the example of short time-frames, then it is possible that participants perceive mood items differently on different days or that they subjectively redefine constructs based on their earlier answers. However, if different days are not comparable with each other in terms of measurement, then an aggregation of daily emotions across

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the days into mood variability scores would not be justified. This is of course a pertinent issue in the present thesis, given that mood variability is based on day-to-day mood changes.

Another issue can arise when considering larger time-frames, namely years, especially during the developmental period of adolescence. Although major developmental milestones with regard to emotional development have been achieved before adolescence, youths still need to refine their emotional competencies (Rosenblum & Lewis, 2003). Thus, if older adolescents have a better insight into their emotional lives and can better identify different emotions in comparison to younger adolescents, then the measurement of daily emotions might not be equivalent across different years and developmental comparisons would not be justified. For instance, if older adolescents employ a different threshold for rating their emotions, then mean comparisons across years would be biased.

Lastly, another important factor that is considered in this dissertation is adolescent sex. For instance, it has often been stated that girls report more intense emotions than boys (Larson et al., 2002; Silk et al., 2003), but without knowing if the measurement is equal between boys and girls, these findings may just be measurement artifacts. There is for instance evidence that girls can better identify and differentiate between different emotions (Gur, Richard, Calkins, Chiavacci, Hansen, Bilker et al., 2012). If girls are better reporters of their internal emotional states, then comparisons between boys and girls on self-reported emotions might be biased.

To address the question whether the measurement of daily emotion self-reports is equal across time and sex and can therefore be unbiasedly compared, we will test whether daily diary reports of adolescent emotions are measurement invariant across short-term intervals (i.e., days within weeks), long-term intervals (i.e., days across years), and adolescent sex (i.e., boys versus girls; Chapter 2). This research question also forms an important prerequisite for the research questions

that will be outlined later, namely the developmental changes and the longitudinal association with adjustment.

The Role of Average Mood Levels

The underlying theoretical assumption of the present thesis is that frequent and extreme changes in mood indicate difficulties with emotion regulation. However, individuals with high mood variability do not only show more frequent and extreme changes in mood, but also more negatively tuned emotions in general. Statistically speaking, mood variability (i.e., changes in mood) and mood level (i.e., average emotional tone) are highly correlated (Ebner-Priemer et al., 2009; Eid & Diener, 1999; Russell, Moskowitz, Zuroff, Sookman, & Paris, 2007; Trull et al., 2015). In order to be able to draw the conclusion that associations between mood variability and other external variables are really due to frequent and extreme changes in mood and not due to the more negative emotional tone that individuals with high mood variability experience, it has been recommended to take into account mean emotion levels in the study of individual differences of mood variability (Ebner-Priemer et al., 2009; Houben, Van Den Noortgate, & Kuppens, 2015; Rusby, Westling, Crowley, & Light, 2013; Trull et al., 2015). Controlling for mean levels thus addresses the question whether mood variability is a construct with unique importance for psychopathology and not just a mere correlate of average negative mood levels.

To address this issue, we will account for average mood levels when studying individual differences in mood variability (Chapter 3, 4, and 5). Moreover, to more explicitly study the relation between variability and level, we will also compare the developmental changes in mood level and mood variability across adolescence (Chapter 2 and 3). These questions can provide further evidence for the distinction between level and variability and the unique importance of mood variability as a construct. After having outlined issues that need to be considered in terms of the measurement of mood variability, I will now outline the more content-related

questions that will be addressed in this dissertation, namely developmental changes and association with adjustment.

Developmental Changes in Mood Variability

Adolescence represents a sensitive period for the development of mood variability. When children enter adolescence, they are confronted with a number of developmental challenges, such as adjusting to hormonal and biological changes (Buchanan, Eccles, & Becker, 1992; Somerville, Jones, & Casey, 2010), temporary disturbances in relationship with parents (Laursen & Collins, 2009), dealing with peer pressure (Brown, 2004), and establishing a coherent identity (Meeus, 2011). Indeed, studies show that adolescents report increases in potentially stressful events when entering adolescence (e.g., more conflicts with parents or problems at school; Ge, Lorenz, Conger, Elder, & Simons, 1994; Larson & Ham, 1993). Such negative events have been shown to be associated with generally more negative and variable moods (Flook, 2011; Herres, Ewing, & Kobak, 2015; Klimstra, Kuppens, Luyckx, Branje, Hale, Oosterwegel et al., 2015; Larson, Clore, & Wood, 1999; Larson & Ham, 1993; Lehman & Repetti, 2007; Schneiders et al., 2006; Timmons & Margolin, 2015; Weinstein & Mermelstein, 2007; Weinstein et al., 2006). Apart from the increase in developmental stressors, there is also a change in how adolescents experience them. Cognitive abilities become more sophisticated in early adolescence, which enables adolescents to “see beneath the surface of situations” (Larson & Richards, 1994, p. 86). This may lead to a higher emotional vulnerability in the beginning of adolescence, in the sense that adolescents are overall more affected by negative life events and respond with more negative emotions than children (Larson & Ham, 1993; Larson & Richards, 1994; Rosenblum & Lewis, 2003).

Unfortunately, research on developmental changes in adolescent mood variability using time-intensive measures surprisingly is still scarce. There are some cross-sectional studies that suggest that mood variability does not differ across different age groups from late childhood to middle adolescence (Larson & Lampman-Petratis, 1989; Silk et al., 2003) and a cross-sequential study indicating

that mood variability increased across adolescence, albeit only for girls (Larson et al., 2002). While the study by Larson et al. (2002) was the only study that used data from two time points, there was a four-year difference between them (ages 10-14 at time 1, ages 13-18 at time 2). This makes it difficult to specify periods of greatest change. Second, only Silk et al. (2003) examined the variability of different emotions. Examining different emotions is however potentially important, taking into account the distinctness of emotions (Russell, 1980). That means that we simply do not know whether the development of mood variability is the same for different emotions. Is it more difficult to regulate happiness than it is to regulate anxiety during adolescence? Moreover, adolescent boys and girls likely differ in general on their mood fluctuations (e.g., girls have been shown to show more mood variability compared to boys; Silk et al., 2003), however few studies explicitly tested whether boys and girls also differ on their developmental trajectories. Therefore, in order to address the limitations of previous studies, we will examine average changes in the development of mood variability for different emotions (happiness, anger, sadness, anxiety) across adolescence as well as possible sex differences in these developmental changes (Chapter 3).

Moreover, individuals differ in the way they experience and regulate their moods and therefore adolescents also likely differ in their mood variability development. For instance, although adolescence is likely a time of great emotional change with probably more negative and fluctuating moods (Arnett, 1999), this might certainly not apply to all adolescents. In fact, it has been often stated that most adolescents may successfully cope with the challenges that are central in adolescence (Buchanan & Hughes, 2011; Cicchetti & Rogosch, 2002; Dahl, 2004). However, some adolescents might in general be more emotionally reactive to stressful events than others. Studies show for instance that differences in genetic make-up have been linked to greater emotion fluctuations in response to stressors (Conway, Slavich, & Hammen, 2015; Wichers, Myin-Germeys, Jacobs, Peeters, Kenis, Derom et al., 2007). If more susceptible adolescents are confronted with developmental stressors that are characteristic of the adolescent period, then they

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may experience even stronger emotion fluctuations in reaction to the pile-up of challenges. In order to receive a better insight into the heterogeneity of mood variability development, we will additionally test whether there are distinct subgroups of adolescents with different developmental trajectories of mood variability (Chapter 4).

Association between Mood Variability and Adjustment

Mood Variability and Psychopathology

There is a heightened risk of psychopathology during adolescence (Cicchetti & Rogosch, 2002), with at least temporary increases in externalizing symptoms, such as delinquency (Laird, Pettit, Bates, & Dodge, 2003) and alcohol use (Chassin, Flora, & King, 2004), and internalizing symptoms, such as generalized anxiety (Nelemans, Hale, Branje, Raaijmakers, Frijns, van Lier et al., 2014), and depressive symptoms (Cole, Tram, Martin, Hoffman, Ruiz, Jacquez et al., 2002). Although certain temporary increases of such symptoms may be normative during that time, they may lead to ongoing difficulties in later life, including lower educational attainment, poorer social functioning, and continued psychopathology in adulthood (Bardone, Moffitt, Caspi, Dickson, & Silva, 1996; Hill, White, Chung, Hawkins, & Catalano, 2000; McGue & Iacono, 2014; Pine, Cohen, Gurley, Brook, & Ma, 1998). Due to its short-term and long-term consequences, it seems of utmost importance to study which factors are involved in the development of adolescent psychopathology.

We propose that mood variability is an important factor in the development of psychopathology. As previously mentioned, heightened mood variability is an important indicator of emotional dysregulation (Cole & Hall, 2008; Hoeksma et al., 2004), which is in turn a central feature in psychopathology (Bradley, 2000; Cole & Hall, 2008; Cole, Michel, & Teti, 1994; Gross & Muñoz, 1995). Recently, it has been argued that one way to advance the study of the role of emotion regulation in psychopathology is to consider emotional processes at the micro-level (Trull et al., 2015; Wichers, 2014; Wichers et al., 2015). For instance, Wichers (2014) suggested

that changes in momentary emotional states may play an important mediating role between risk factors, such as negative life events or genetic vulnerability, and psychopathology. If individuals repeatedly experience fluctuations in their moods in response to such risk factors, then this may initiate cascades of alterations in emotions and behaviors, which may consequently put some individuals at risk for developing symptoms of psychopathology (Wichers et al., 2015).

There is accumulating evidence for the role of mood variability in interindividual differences in psychopathology, especially in the past years. A recent meta-analysis showed for instance that highly unstable moods were in general associated with poorer psychological well-being, including less life satisfaction, more neuroticism, more depression, more anxiety, and more externalizing behavior (Houben et al., 2015). Despite this, studies using longitudinal designs and studies conducted in adolescents are generally sparse. Considering that many psychopathologies originate in adolescence (Paus, Keshavan, & Giedd, 2008), which can lead to long-lasting problems in later life (Dahl, 2004), using longitudinal designs across adolescence is important to elucidate the timing and nature of associations between mood variability and psychopathology. For instance, do differences in the development of mood variability have any implications for psychological health across adolescence? Similarly, is heightened mood variability just a byproduct of psychopathology, or is it driving psychopathology development? In the present dissertation, we will specifically study whether adolescents' distinct mood variability trajectories coincide with differences in levels and developmental changes in psychopathology and alcohol use across adolescence (Chapter 4). Second, we will address the issue of directionality between mood variability and psychopathology to gain a better understanding whether mood variability exacerbates psychopathology, whether psychopathology exacerbates mood variability, or whether both mutually influence each other (Chapter 5).

Mood Variability and Psychopathology in a Social Context

Of course, adolescent development does not occur in a vacuum. Taking into account the social context is very important when understanding the role of mood variability in psychopathology development. Negative social experiences are often associated with increases in psychopathology, especially internalizing symptoms. For instance, frequent conflicts may lead to worries about interpersonal relationships and may induce feelings of low self-esteem and negative self-evaluations, thus exacerbating anxiety and depressive symptoms (Borkovec, Alcaine, & Behar, 2004; Rudolph, Flynn, & Abaied, 2008). Although peers become increasingly important during adolescence (Brown, 2004), parents still remain a crucial factor on their children's development (Laursen & Collins, 2009). During adolescence, the parent-adolescent relationship undergoes significant developmental changes with transitions from a parent-dominant into a more egalitarian relationship (Collins & Laursen, 2004). This process is often accompanied by temporary increases in conflicts (De Goede, Branje, & Meeus, 2009), which may partly contribute to increases in internalizing symptoms during that period (Branje, Hale, Frijns, & Meeus, 2010; Hale, Engels, & Meeus, 2006; Sheeber, Hops, Alpert, Davis, & Andrews, 1997; van Eijck, Branje, Hale, & Meeus, 2012).

One possible underlying factor in the link between parent-adolescent conflicts and internalizing symptoms may be how adolescents regulate their moods. Frequent conflicts with parents may be perceived as stressful and impair emotion regulation capacities (Bradley, 2000; Thompson & Meyer, 2007), thus leading to more fluctuations in daily moods (Flook, 2011; Weinstein et al., 2006), which then might increase internalizing symptoms (Silk et al., 2003). However, longitudinal studies during adolescence elucidating that link are still sparse (Morris et al., 2007). Therefore, an additional goal of the present dissertation is to examine the role of mood variability in the link between parent-child conflicts and internalizing problems (i.e., generalized anxiety and depressive symptoms; Chapter 5).

The Present Thesis

Research Questions

To summarize, the overall aims of the present thesis were to study the development of mood variability and its association with adjustment. The following topics and research questions will be addressed in the present dissertation (see Figure 1.1 for an overview):

1. *Measurement of mood variability.* The first overarching topic of this dissertation concerns the measurement of mood variability. Here, we will specifically address the following two questions:
 - a. Measurement invariance across time and sex: Are daily emotions as collected with internet daily diaries across the period of adolescence measurement invariant across time (i.e., days within weeks and days across years) and sex (Chapter 2)? This research question is an important prerequisite for the other research questions, because it evaluates whether developmental changes and sex differences are due to true differences and not due to differences in the measurement.
 - b. The role of average mood level: To what extent is mood variability a unique construct that is different from average negative mood level? In order to ensure that the associations found in the present study also hold after accounting for average mood levels, we will use average mood levels as a covariate in our analyses (Chapter 3, 4, and 5). Moreover, we will also explicitly test for developmental changes of mood levels to see whether these are similar to the changes in mood variability (Chapters 2 and 3).
2. *Developmental changes in mood variability.* The second overarching topic of this dissertation concerns the development of mood variability. We will specifically address two questions:
 - a. Average development: What are the average developmental changes in adolescent mood variability of happiness, anger, sadness, and anxiety from early to late adolescence? Moreover, are there sex differences in

these developmental trajectories, both in the initial level and the rate of change (Chapter 3)?

- b. Distinct trajectories: Do the average changes established in Chapter 3 apply to all adolescents or are there subgroups of adolescents with distinct developmental trajectories of mood variability (Chapter 4)?
3. *Association between mood variability and adjustment*: The third overarching topic of this dissertation is the role of adolescent mood variability in the development of psychopathology in the parent-adolescent context. Here, we will specifically focus on the following questions:
- a. Mood variability and psychopathology: Does the development of three core adolescent adjustment problems (i.e., depressive symptoms, delinquency, alcohol use) vary as a function of distinct mood variability trajectories (Chapter 4)? Furthermore, what is the direction of effects between mood variability and internalizing problems (Chapter 5)?
 - b. Mood variability and psychopathology in an interpersonal context: What is the role of mood variability in the relation between parent-adolescent conflicts and internalizing symptoms (Chapter 5)?

Design

To address the research questions that were just outlined, data from the RADAR-y cohort (Research on Adolescent Development And Relationships; young cohort) were used. The RADAR project is a longitudinal research project in the Netherlands, in which 497 adolescents and their families and friends were followed since they were 12 years old. The study is still ongoing and the ninth data collection wave will start in Autumn 2016 (adolescents are then approximately 22 years old). For the present thesis, data were used from ages 13 to 20 (data collection: 2006-2013), which were collected during home and internet assessments (see Table 1.1 for an overview of the study design). The home assessments took place once per year (ages 13-20). During these home assessments, adolescents filled out questionnaires about adjustment, including anxiety, depression, delinquency, and

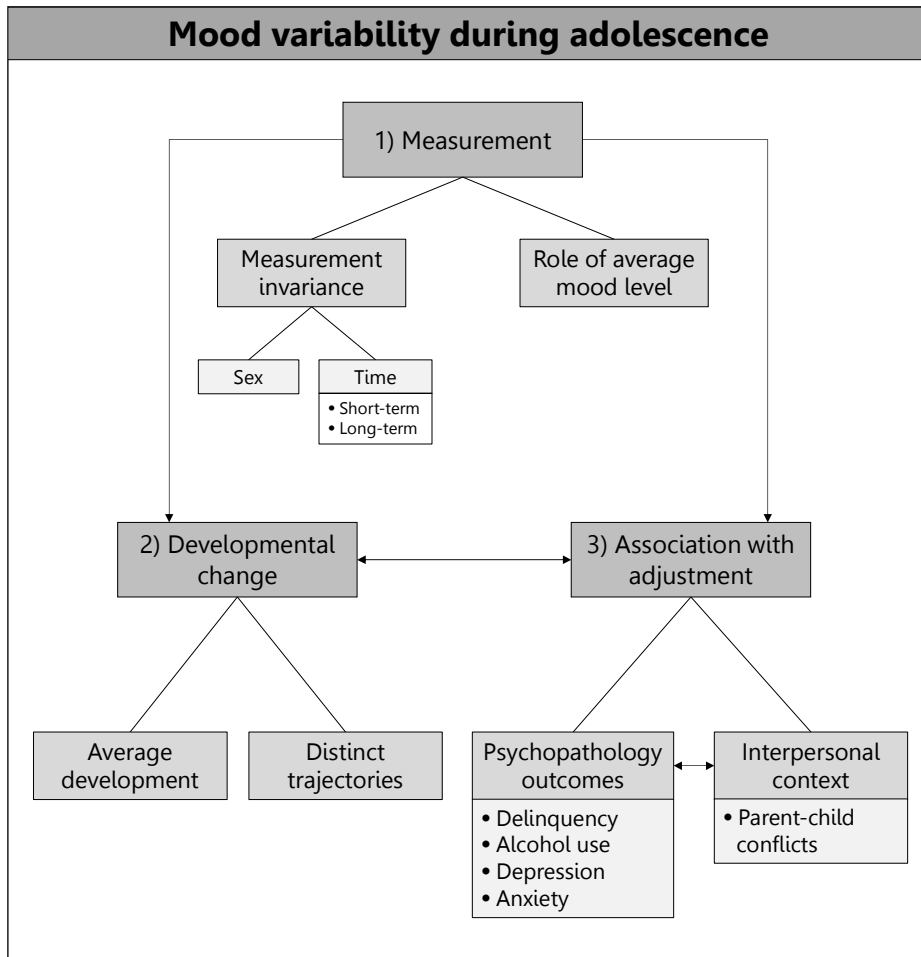


Figure 1.1. Topics addressed in the present thesis

alcohol use, and about the intensity of conflicts with their mother and their father³. Moreover, both mothers and fathers reported on the intensity of conflicts with the adolescent. Next to these home assessments, adolescents also completed a number of daily internet assessments across the course of five years (ages 13-18). These internet assessments took place three times per year and lasted for one week each (i.e., Monday to Friday; 15 weeks and 75 days in total). Using these daily mood data, we calculated day-to-day mood changes as an index of adolescent mood variability.

³ Although the RADAR study contains many more assessments, only the measures relevant for the present thesis will be outlined here.

Table 1.1.

Overview of the Study Design

Age	Assessments																					
	Year 1			Year 2			Year 3			Year 4			Year 5			Year 6	Year 7					
	T1.1	T1.2	T1.3	T1.4	T2.1	T2.2	T2.3	T2.4	T3.1	T3.2	T3.3	T3.4	T4.1	T4.2	T4.3	T4.4	T5.1	T5.2	T5.3	T5.4	T6.1	T7.1
13/14	H	I	I	I																		
14/15					H	I	I	I														
15/16									H	I	I	I										
16/17													H	I	I	I						
17/18																	H	I	I	I	H	
20																						H

Note: H = Home visits, I = Internet assessments. During the home visits, adolescents reported on their adjustment (anxiety symptoms, depressive symptoms, delinquent acts, alcohol consumption). Adolescents and both parents also reported on parent-adolescent conflicts. During the internet assessment weeks, adolescents rated their daily emotions (Monday to Friday). Based on these daily emotion scores, day-to-day mood changes were calculated as an index of adolescent mood variability. The home visits were separated by approximately one year, except for T6.1 and T7.1, which were separated by two years. The internet assessment weeks were separated by approximately three months.

Structure of the Thesis

As outlined, the present thesis addresses three broad research topics, namely issues in the measurement of mood variability, the developmental changes in mood variability across adolescence, and the association of mood variability with both psychopathological outcomes and the interpersonal context (see Table 1.2 for an overview of the study design and research aims per chapter): In Chapter 2, we will test whether daily emotion reports are measurement invariant across sex, short-time intervals (i.e., days within weeks) and long-time intervals (i.e., days across years). Moreover, we will study sex-specific average developmental changes in mood level (happiness, anger, sadness, anxiety). In Chapter 3, we will study sex-specific average developmental changes in mood variability (happiness, anger, sadness, anxiety). In Chapter 4, we will examine whether there are distinct developmental trajectories of mood variability and how adolescents with distinct mood variability trajectories differ on their development of depressive symptoms, delinquent acts, and alcohol consumption. In Chapter 5, we will test for developmental links between parent-child conflicts and anxiety and depressive symptoms and whether mood variability acts as a mediating variable in this relationship. In all chapters, we also consider average mood levels as a possible confounding variable. Finally, in Chapter 6, the main findings of the present thesis are summarized and discussed, and the limitations and implications for future research and practice are outlined.

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Table 1.2.

Overview of the Study Design and Research Aims for Chapter 2 to 5

Chapter	Study design	N	Waves (Internet/Home)	Ages	Research Aim
2	Longitudinal	394	15 (Internet)	13-18	Measurement invariance across time and sex Developmental changes in mood level
3	Longitudinal	474	15 (Internet)	13-18	Developmental changes in mood variability
4	Longitudinal	482	22 (15 Internet, 7 Home)	13-20	Distinct mood variability trajectories Differences in the development of depressive symptoms, delinquency, alcohol use as a function of distinct trajectories
5	Longitudinal, multi-informant	456	13 (9 Internet, 4 Home)	13-16	Developmental links between anxiety and depressive symptoms, mood variability, and parent-adolescent conflicts

Note. The measures are a combination of annual home assessments and weekly internet assessments. During the annual home assessments, psychopathology and parent-adolescent conflict were measured. During the weekly internet assessments, daily emotions were measured across five days for three weeks per year. The total sample size of the RADAR-y cohort is 497. The sample size differs between the chapters due to differences in inclusion criteria related to the research question (explained in each chapter).